IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Appln. No:	09/548,511
Applicant:	José P. Arencibia, Jr.
Filed:	April 13, 2000
Title:	TEMPERATURE CONTROLLED REACTION VESSEL
TC/A.U.:	1764
Examiner:	B. A. Ridley
Confirmation No.:	6778
Notice of Appeal Filed:	April 14, 2004
Docket No.:	ECG-100US

APPEAL BRIEF UNDER 37 C.F.R. § 1.192

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Commissioner for Patents
P. O. Box 1450
Alexandria, VA 22313-1450

SIR:

The Applicant (now Appellant) appeals from the Final Rejection dated January 15, 2004, which finally rejected claims 1, 2, 4 and 5 of the subject application.

A Notice Of Appeal was forwarded under a Certificate of Mailing dated April 14, 2004, acknowledge as being received on April 16, 2004, by the United States Patent and Trademark Office.

I. REAL PARTY IN INTEREST

The real Party In Interest is Appellant José P. Arencibia, Jr.

II. NO RELATED APPEALS AND INTERFERENCES

There are no related appeals or interferences known to the Appellant, or the Appellant's legal representative, which would directly affect, be directly affected by, or have a bearing on the Honorable Board's decision in this Appel.

III. STATUS OF CLAIMS

Claims 1, 2, 4 and 5 stand as finally rejected. Claim 1 is an independent claim. Claims 2, 4 and 5 depend on claim 1.

Appellant respectfully submits that independent claim 1 is patentable and, relies, for support of this contention on the arguments presented herein below. In view of the fact that claim 1 is patentable, claims dependent thereon would also be patentable. In summary Appellant is appealing the Examiner's requirement under 35 U.S.C. § 121 and the decision of finally rejecting claims 1, 2, 4 and 5.

IV. STATUS OF AMENDMENTS

The above-identified application was filed on April 13, 2000. The above-identified application relies on the priority of U.S. Patent Application Serial No. 08/878,372 filed June 18, 1997, of which the above-identified application is a continuation-in-part. The original application contained 20 claims. On April 7, 2003, the Examiner issued a Communication requiring an election/restriction under 35 U.S.C. § 121. the Examiner alleged the application contained three separate inventions, grouped as follows:

> "I. Claims 1-5, drawn to a chemical reactor, classified in Class 422, Sub-class 202,
>
> II. Claims 6-13 and 16-20, drawn to system for controlling temperature of a vessel,
>
> III. Claims 14-15, drawn to an apparatus for supplying gas to a helical channel coil, classified in Class 165, Sub-class 108. There were no substantive rejections in this Communication."

Under certificate of mailing dated 28 April 2003, Appellant responded to the Restriction Requirement under 35 U.S.C. § 121, traversing the requirement and arguing the impropriety of the Restriction Requirement. In accordance with the Rules of Practice, Appellant elected to prosecute claims 1-5, identified as the claims of Group I.

The Examiner issued a Non-Final Office Action on July 17, 2003. The Examiner responded to Appellants arguments concerning the Elections/Restriction Requirement and made the requirement final. At the same time claims 6-20 were withdrawn from consideration pursuant to 37 C.F.R. § 1.142(b), as being drawn to a non-elected invention. The Examiner objected to the specification and drawings setting forth a litany of objections thereto.

In addition the Examiner rejected claims 1-5 under 35 U.S.C. § 103(a) over GB 871,752 in view of Dallmeyer et al. U.S. Patent 5,387,396. The Examiner also rejected claims 2-3 under 35 U.S.C. § 103(a) over GB 871,752 in view of Dallmeyer et al. and further in view of Deane U.S. Patent 2,744,391 or Matsugi et al. U.S. Patent 5,667,758.

Appellant filed a response under cover of a certificate of mailing dated 17 October 2003, to the Official Action, the amendment including detailed amendments to the specification and drawings. In addition, Appellant amended claim 1 and cancelled claim 3, claims 2, 4 and 5 remaining as filed. Claims 6-20 were treated as being withdrawn. Appellant further argued the impropriety of the substantive rejection of claims 1, 2, 4 and 5.

The Examiner issued a Final Rejection on January 15, 2004. The Final Rejection included a further litany of objections to the specification and drawings. In addition, the Examiner rejected claims 1-2 and 4-5 under 35 U.S.C. § 103(a) as unpatentable over GB 871,752 in view of Dallmeyer et al. (U.S. Patent 5,987,396), further in view of Deane U.S. Patent 2,744,391 or Matsugi et al. U.S. Patent 5,667,758. Under cover of a certificate of mailing 18 March 2004, Appellant filed an Amendment under 37 C.F.R. § 1.116 further amending the specification and drawings without further amending the claims and without responding to the substantive rejections by the Examiner.

On April 6, 2004, the Examiner issued an Advisory Action refusing to enter the Amendment after Final.

Appellant filed a Notice of Appeal under certificate of mailing dated April 14, 2004.

V. SUMMARY OF INVENTION

The present invention is an insulated chemical or biological reactor (such as a fermenter) system comprising a reaction vessel, an evacuated insulation shell, a plurality of temperature controlling mixing baffles immersed in the reactor contents and a temperature controlling helical channel coil outside of the reactor but inside the evacuated shell. A device designed to control the separation of phases of the working fluid chosen is required and may be external to the reactor. This device is referred to as the phase separator and has two outlets, one for each phase of the working fluid. The temperature controlling mixing baffles are designed to accept the working fluid in a single phase proceeding from one outlet of the phase separator and to, in turn, cause this fluid to change phase therein without carryover of any of the inlet fluid in the evolved phase. The changing of phase of the working fluid in the temperature controlling mixing baffles takes place at a uniform temperature, the level of which is dictated by the thermodynamic properties of the working fluid selected. The temperature controlling mixing baffles are referred to as isothermal mixing baffles. The channel coil is adapted to accept a circulating fluid, specifically of a single phase evolved by the mixing baffles and the other outlet of the phase separator. The particular working fluid selected depends on the intended temperature control purposes, that is whether heating or cooling is desired and the degree of heating or cooling needed. The channel coil is affixed to the outside wall of the reactor in a helical configuration and adapted to receive the single phase of the working fluid evolved by the mixing baffles and the other outlet of the phase separator which flows spirally upward or downward around the outside of the reactor. The channel coil is shaped to have two straight, parallel sides of the coil in contact with the reactor, normal to the surface of the outside wall of the reactor. This right angle contact between the channel coil and reactor wall increases the section modulus of the vessel wall, and thereby increases the mechanical strength of the reactor wall under external pressure. The wall can thus be made thinner to promote better heat transfer across the wall. The reactor, including the mixing baffles and the affixed coil, are together enclosed within an evacuated jacket.

The separation of the phases of the working fluid is very important for the optimal and predictable operation of the present invention, particularly when cooling of the reactor contents is anticipated. In the cooling mode the isothermal

cooling baffles are intended to boil the working fluids which enter as a liquid and evolve only a saturated vapor with no liquid carryover in the form of droplets or mist. The isothermal mixing baffles, therefore, operate in the boiling heat transfer regime exchanging the latent energy of vaporization (at constant temperature) with the reactor contents. The vapor evolved from the isothermal mixing baffles, as well as the vapor evolved from the phase separator upstream therefrom is commingled and directed to enter the helical channel coil that serves as the reactor external jacket, wherein it exchanges sensible thermal energy with the reactor contents, gaining temperature to approach that of the reactor contents as it travels further along the inside of the coil.

The present invention thus controls heat transfer regimes by assuring that distinct single phases will exist in the isothermal mixing baffles (boiling liquid for cooling mode; condensing vapor for heating mode) and helical channel coil (vapor increasing in temperature for cooling mode; liquid decreasing in temperature for the heating mode).

The isothermal mixing baffles , of which there are typically at least two, are vertically oriented, elongated, generally cylindrical devices with an inlet and an outlet. As with the jacket, the isothermal mixing baffles may be used for heating or cooling the contents of the reaction vessel. Where heating is desired, a hot liquid or gas can be introduced into the isothermal mixing baffles through the inlet. The resultant cooler liquid or condensed vapor or liquid can be removed via the outlet. Where cooling is desired, upstream of the isothermal mixing baffles inlet there is provided a phase separator to insure only a liquid stream enters the isothermal mixing baffles. The inlet to the isothermal mixing baffles is typically placed into the top of the reactor and a liquid of desired boiling point is allowed to enter the isothermal mixing baffles while the reactor is in use. Where cooling is desired, the liquid selected would have a boiling point at or below the desired reaction temperature. The heating and boiling of the liquid introduced into the isothermal mixing baffles provides for the removal of heat from the reactor contents. For additional temperature control, the vapor produced from the boiling of the isothermal mixing baffles contents may be taken from the top of the isothermal mixing baffles, comingled with gas emanating from the phase separator and passed through the channel coil surrounding the outside of the reaction vessel.

The isothermal mixing baffles are designed and arranged so that their combined cross-sectional area will be such that the velocity of the vapor evolved from the liquid phase boiling therein will be below a critical value, Uc, above which droplets or slugs of the liquid phase will be entrained in the evolved gas and expelled from the isothermal mixing baffles. To accomplish this requirement, the inlets and outlets of the isothermal mixing baffles will be piped in parallel.

In one aspect the present invention is an insulated chemical reactor comprising; a reaction vessel having a wall with inner and outer surfaces, an evacuated insulation shell spaced apart from and surrounding the reaction vessel, at least one isothermal mixing baffle disposed within the reaction vessel, a phase separator in fluid communication with the baffle so that only one saturated or sub-cooled liquid phase of a heat transfer working fluid enters the isothermal mixing baffle, a temperature controlling helical channel coil fixed to the outer surface of the wall of the reaction vessel, the helical channel coil having at least two walls disposed normal to the outer surface of the wall of the vessel, thus defining an open helical channel coil fixed to the wall of the vessel, the helical channel coil having a winding pitch so that successive coils of the channel coil are spaced apart from each other, thus defining a closed path to receive a fluid to contact the wall of the reaction vessel, the wall of the reaction vessel being of a thickness less than that required for use under a given temperature and pressure regime, the channel coil serving to add structural strength to the wall of the reaction vessel, so that the reaction vessel with the channel coil fixed thereto can be operated under the temperature and pressure regime; the helical channel coil fixed to the outer surface to enhance conductive heat transfer and transfer of convective energy flow inside the helical channel coil through the wall of the vessel; and means to combine vapor from the phase separator and vapor from the isothermal mixing baffle and introduce the vapor into the helical channel coil.

Present claims 1, 2 and 4-5 are drawn to an insulated chemical reactor.

Appellant respectfully contends that the finally rejected claims are patentable over GB 871,752, Dallmeyer et al. U.S. Patent 5,387,396, Deane U.S. Patent 2,744,391, or Matsugi et al. U.S. Patent 5,667,758, as well as art of record in

the application. None of the art available at the time Appellant made his invention would have led a worker skilled in the art to solve the problem addressed by Appellant. Even, assuming that the references were combined, the claimed invention is patentably distinct from those references as combined in the absence of further modification of, which modification can only be accomplished by using Appellant's own teaching to not only select, but to interpret the references. Lastly, Appellant contends each of the cited references individually teach away from the modifications necessary to the references either individually or collectively to achieve Appellant's invention.

VI. ISSUES

(1) Was the requirement under 35 U.S.C. § 121 proper.

(2) Were claims 1-2 and 4-5 properly rejected under 35 U.S.C. § 103(a) as being unpatentable over GB 871,752 in view of Dallmeyer et al., further in view of Deane, or Matsugi et al.

VII. GROUPING OF CLAIMS

Claims 1-2 and 4-5 stand as a genus description of the invention.

VIII. ARGUMENT

For the reasons set forth below Appellant respectfully submits that the Final Rejection was improperly put forth and should be withdrawn:

A. The Requirement Under 35 U.S.C. § 121 was Improper.

Appellant respectfully submits that the invention is claimed in a fashion with a genus defined in claims 1-5 as the reaction vessel with all necessary parts, which the Examiner has indicated to be the claims of Group I. The apparatus (reaction vessel) of claims 1-5 is claimed as used in an isothermally cooling mode (claims 6-13), the reaction vessel including means to supply saturated or superheated gas into the helical channel coil disposed around the reaction vessel (claims 14-15), and the method of using the apparatus of claims 1-5 in a temperature controlling mode claims (16-20).

It is respectfully submitted that in its generic form the invention contains a reaction vessel, an isothermal mixing baffle disposed within the reaction vessel, a phase separator in fluid communication with the baffle, a temperature controlling helical channel coil fixed to the outer surface of the reaction vessel and means to combine vapor from the phase separator and vapor from the mixing baffle to be introduced as vapor into the helical channel coil.

Depending upon the connection between the phase separator and the isothermal mixing baffle the reactor can be used either to heat or cool the contents inside the reaction vessel.

The shape of the outside wall of the reaction vessel can either be cylindrical or conical depending upon the use to which the reactor is placed. The mere change in shape of the wall of the reaction vessel without changing any of the other required elements would, in the opinion of Appellant, not define a patentably distinct invention but an alternate embodiment of the basic invention.

It is well settled that the mere differences between classifications does not give rise to sustaining a restriction requirement.

The Examiner has also alleged that there are patentably distinct species. Appellant respectfully submits that this assertion is simply wrong. For the reasons set forth above the mere change in the shape of the wall of the reaction vessel or the positioning of the isothermal mixing baffle does not give rise to a patentably distinct invention. The basic invention is the combination of the reaction vessel, the isothermal mixing baffle, the phase separator, the temperature controlling helical channel coil and means to introduce vapor into the helical channel coil. Therefore, it is respectfully submitted that, contrary to the allegation of the Examiner, there are no species 1-3.

The Examiner has called out the various embodiments of the isothermal heating baffle as species of the invention. These are merely sub-assemblies and sub combinations that can be used with the invention as defined in claims 1, 2 and 4-5.

As set out above, the present invention is a combination of a reaction vessel, an isothermal mixing baffle, a phase separator, a temperature controlling helical channel coil fixed to the outer surface of the reaction vessel and means to combine vapor from the phase separator and vapor from the isothermal mixing baffle, which is introduced into the helical channel coil.

Appellant has chosen to claim various sub features of the present invention as stand alone items which have unique features, neither disclosed nor suggested in the prior art.

In view of the foregoing it is respectfully submitted that the restriction requirement is not well taken and should be withdrawn.

For the reasons set forth above Appellant believes that the species identified by the Examiner as 1, 2 and 3 are but a single invention and the mere placement of the isothermal mixing baffles and the shape of the outer wall of the reaction vessel do not define separate inventions.

In view of the foregoing arguments it is respectfully submitted that the Requirement under 35 U.S.C. § 121 should be reversed.

B. Claims 1-2 and 4-5 are not Obvious over GB 871,752 in view of Dallmeyer et al., further in view of Deane, or Matsugi et al.

Appellant has in claim 1 defined features of the invention that are neither taught nor suggested in the prior art, namely:

> ". . . a temperature controlling helical channel coil fixed to said outer surface of said wall said reaction vessel, said helical channel coil having at least two of flat parallel walls disposed normal to and in contact with the outer surface of said wall of said vessel, thus defining a open helical channel coil fixed to said wall said vessel, said helical channel coil having a winding pitch so that successive coils of said channel coil are spaced apart from each other, thus defining a closed path to receive fluid to contact said wall of said reaction vessel, said wall of

said reaction vessel being of a thickness less than that required for use under a given temperature and pressure regime, said channel coil serving to add structural strength to said wall of said reaction vessel, . . . "

". . . means to combine vapor from said phase separator and vapor from said isothermal mixing baffle and introduce said vapor into said helical channel coil. . . ."

At the outset Appellant can not too strongly point out that the Examiner has fallen into the trap of using Appellant's specification to not only select but to interpret the references. This is clearly contrary to existing Patent Law.

Appellant respectfully submits that nowhere in the British Reference does the Patentee disclose a helical channel coil having at least two flat parallel walls disposed normal to and in contact with the outer surface of the wall of the vessel. Furthermore, the British Patent nowhere teaches or suggests that the channel coil adds structural strength to the vessel. In point of fact, the coil 5 in the British Patent at page 2, line 49-52 is described as follows:

"The lower part 3 is provided on its outer side with a welded pressure-resistance coil 5, for example, having a semi-tubular cross section."

The British Patent only uses a coil covering part of the outer surface of the inner vessel whereas Appellants channel coil covers the entire outer vertical portion of the inner vessel. Furthermore, Appellant calls the Honorable Board's attention to the description of the vessel of the British Patent described beginning on line 52 of page 2, continuing through line 86 of page 2, to wit:

"The space between the exterior casing and the interior reaction vessel is rendered heat insulating in accordance with the invention, for example, by means of a filling of a ceramic heat insulation material. Advantageously the space between the exterior casing and the interior reaction vessel disconnected through an automatic pressure equalizing device

> with a source of compressed gas in such manner that the pressure in said space is maintained approximately equal to the pressure inside the reaction vessel.
>
> The exterior pressure resistant casing may be constructed in a manner similar to that of known autoclaves. Since this casing does not come into contact with the substances taking part in the chemical reaction, it is advantageously constructed of a material well adapted to take a high pressure without having to take into account the chemical resistance of the material used for this purpose. Thus, it may be made, for example, of cast steel. The insulating material between the exterior casing reaction vessel must be so constructed that it can transmit to the exterior casing the pressure prevailing in the reaction vessel without deformation of the latter, or that, in the case of the pressure equalization described below, it offers no resistance to equalization to gas pressure within said space. Advantageously, there is used an insulation consisting of Rashing rings, Berl saddle-shaped bodies, stoneware balls or the like or a heat insulating fluid."

Appellant respectfully submits that the British Patent neither teaches nor suggests the use of an exterior channel shaped heating coil to add structural strength to the inner vessel. The British Patent relies upon the structural insulation between the inner and outer vessels to maintain the structural integrity of the inner vessel. Alternatively, the space between the inner and outer vessel can be pressurized to maintain the shape and integrity of the inner vessel – a procedure strictly prohibited by internationally accepted pressure vessel codes, including the ASME Code. This is clearly directly opposite to the teaching of Appellant which relies on the helical channel coil to not only add structural strength – by increasing the area moment of inertia "I" through the use of the orthogonal coil members prescribed by Appellant with the inner vessel but to provide additional cooling or heating of the inner vessel –by reducing the thickness of the wall through which the heat will conduct, only made possible by the aforementioned increasing of the area moment of inertia "I". Thus, the teaching of the British Patent is directly opposite to

that of the present invention. Contrary to the allegation of the Examiner, there is no teaching in the art to use the helical channel coil to add structural strength to the inner vessel. This teaching is only gleaned from Appellants specification when used to interpret the teaching of the British Patent. Appellant submits that the British Patent only places the coil of a semicircular cross section on a portion of the inner vessel so that in no way the coil can be used to add structural strength to the wall of the inner vessel. The British Patent is silent as to the thickness of the inner vessel and, if thin, it must be supported by the insulation not by the coil surrounding only a portion of the inner vessel.

Appellant respectfully challenged the Examiner to show by other than mere supposition the allegation of obviousness or of what is within the ordinary skill in the art referred to in competent prior art. The Examiner has failed to carry his burden because competent prior art does not teach or suggest Appellant's invention which for the first time has taught the use of the helical channel coil to add structural strength to a thin walled reaction vessel.

The failure of the teaching of the British Patent is not completed by the Dallmeyer et al. reference since Dallmeyer et al. do not teach or suggest a reaction vessel having an outer helical channel coil to maintain or effect structural strength of a thin wall reaction vessel.

Furthermore, Dallmeyer et al. are inapplicable to the present invention. For example, consider a reactor configured as in Figure 1 of Dallmeyer et al. Furthermore, consider that the cooling fluid is liquid nitrogen, or any other liquid fluid who saturated temperature is below the freezing (or crystallization) point of the reaction fluid. If the boiling tubes 10 of Dallmeyer et al. are configured as shown, ice may form on this surface and heat transfer will collapse. On the other hand Appellants have design uses concentric tubes to control overall heat transfer coefficient where the heat transfer coefficient inside the tubes is less (has to be, based on First Principles) than the heat transfer coefficient outside the tubes, lest ice be formed. In Dallmeyer et al., ice will form on the surfaces 9 and 10 to create zones of unreacted or partially reacted components, quality as well as a safety problem.

Furthermore, the Dallmeyer et al. reactor is for exothermic reactions whereas Appellant's reactor can be used for either exothermic or endothermic reactions.

Dallmeyer et al. requires flow in at 4 and flow out at 6. Appellants design does not require such flow and can apply to flow in the other direction or to a batch (reactor).

Dallmeyer et al.'s use of body flanges 7, 8, 13, and 15 violates current good manufacturing practice (cGMP) criteria required by such regulatory agencies as the FDA and makes the Dallmeyer et al. reactor unusable for most pharmaceutical reactions, as well as potentially creating a very unsafe reactor.

The use of the perpendicular walls of the helical channel coils of the present invention fixed to the reactor vessel are counter intuitive and not obvious due to the fact that it would be easier to coil a half cylinder, resulting in the conventional half-pipe (semi-cross section) jacket than a rectangular channel (square or rectangular cross section) that provides the desired maximum (area moment of inertia, "I"). The design of the present invention was arrived at in order to accommodate the thermal physical properties and allow for the use of a cooling fluid that would otherwise freeze the fluid being cooled and to use the geometry of the helical channel coil to reduce heat transfer resistance.

By way of example, using Appellant's teaching, liquid nitrogen (normal boiling point, NBP = -195°C) can be used as a cooling fluid in a reaction vessel using methanol (normal freezing point, NFP = -95°C) as a reactor working fluid; this would result in a minimum temperature driving force of 100 °C if the apparatus can be made to operate below the NFP of methanol. In the Dallmeyer et al. embodiment, methanol ice will form on the cooling surfaces in contact with the reactor fluid, thus making the temperature driving force between methanol ice and reactor fluid close to 0°C and adding the higher conductive resistance of the methanol ice to the overall heat transfer coefficient – and conductive resistance is 1 to 2 orders of magnitude larger than convective film coefficients. Appellant's invention guarantees that only the desired convective film heat transfer coefficients will be at work.

The methanol ice will trap unreacted components, causing the overall product to be ultimately contaminated and in some cases creating hazardous conditions when the reaction fluid is ultimately warmed up.

In view of the foregoing arguments it is respectfully submitted that the British Patent and the Dallmeyer et al. Patent are fatally defective as references that teach or suggest the salient features of the invention. It is respectfully submitted that the failure of the primary reference is not made whole by either the Dean or Matsugi et al. references. Neither Dean nor Matsugi teach a helical channel coil. In both of these references the entire vessel is jacketed by a heat exchanger that is in complete contact with the outer wall of the device. Here again, the Examiner is making suppositions about the scope of the prior art which can only be made when using Appellants own teaching to not only select but to interpret the references.

It can not be too strongly urged that the Examiner has fallen into the trap of using Appellants teaching to not only select but to interpret the references, this being clearly contrary to existing Patent Law.

The mere fact that the Examiner has combined four references is, in the opinion of appellant, strong evidence of non-obviousness. Combine this with the fact that the references are spaced in time would indicate the problem solved by appellant was neither recognized or a solution apparent to a worker skilled in the art at the time appellant made his invention.

Therefore, it is respectfully submitted that the rejection of claims 1, 2 and 4-5 under 35 U.S.C. § 103(a) is not well taken and should be reversed.

IX. CONCLUSION

In view of the foregoing argument, Appellant respectfully submits that the subject application is in condition for allowance. Appellant respectfully requests that the Honorable Board reverse the Requirement under 35 U.S.C. § 121 and the Final Rejection of claims 1, 2 and 4-5 in the application identified above.

In accordance with 37 C.F.R. § 1.192(a), this Appeal Brief is submitted in triplicate.

Respectfully submitted,

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Dated: August 3, 2004

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3 August 2004

James C Simmons

APPENDIX

A. Claims Finally Rejected

1. An insulated chemical reactor comprising:

a reaction vessel having a wall with inner and outer surfaces;

an evacuated insulation shell spaced apart from and surrounding said reaction vessel;

at least one isothermal mixing baffle disposed within said reaction vessel;

a phase separator in fluid communication with said baffle so that only one saturated or sub-cooled liquid phase of a heat transfer working fluid enters said isothermal mixing baffle;

a temperature controlling helical channel coil fixed to said outer surface of said wall of said reaction vessel, said helical channel coil having at least two flat parallel walls disposed normal to and in contact with the outer surface of said wall of said vessel, thus defining an open helical channel coil fixed to said wall of said vessel, said helical channel coil having a winding pitch so that successive coils of said channel coil are spaced apart from each other, thus defining a closed path to receive a fluid to contact said wall of said reaction vessel, said wall of said reaction vessel being of a thickness less than that required for use under a given temperature and pressure regime, said channel coil serving to add structural strength to said wall of said reaction vessel, so that said reaction vessel with said channel coil fixed thereto can be operated under said temperature and pressure regime; said helical channel coil fixed to said outer surface to enhance conductive heat transfer and transfer of convective energy flow inside said helical channel coil through said wall of said vessel; and

means to combine vapor from said phase separator and vapor from said isothermal mixing baffle and introduce said vapor into said helical channel coil.

2. A reactor as claimed in claim 1, wherein said temperature controlling helical channel coil comprises a generally rectangular shaped channel fixed to said outer surface of said reaction vessel, said channel coil and said wall of said reaction vessel defining a closed fluid flow passage.

4. A reactor as claimed in claim 1, further including insulating material covering an outside surface of said helical channel coil.

5. A reactor as claimed in claim 1, wherein said heat transfer working fluid is selected from the group consisting of nitrogen, helium, brine, steam, chilled water, carbon dioxide, ammonia, CF4, methanol, ethanol, ethane, ethylene, methane, R134A and hot water.

B. Claims withdrawn response to Requirement under 35 U.S.C. § 121.

6. An apparatus for isothermally cooling contents of a reaction vessel having a top and a bottom, by allowing a saturated or subcooled liquid to boil inside an isothermal mixing baffle immersed in said reactor contents, to produce gas inside said isothermal mixing baffle, comprising:

a vertically oriented, elongated generally cylindrical isothermal mixing baffle having a top and a bottom, said isothermal mixing baffle immersed in said contents in said reaction vessel;

means for introducing said liquid into the top of said isothermal mixing baffle to a predetermined level;

means for removing gas from said isothermal mixing baffle; and,

means for controlling the level of liquid in said isothermal mixing baffle.

7. An apparatus as claimed in claim 6, including a phase separator to control flow of liquid into or out of said isothermal mixing baffle.

8. An apparatus according to claim 6, wherein said isothermal mixing baffle is placed to prevent entrained carryover of liquid phase into a channel coil surrounding said reaction vessel.

9. An apparatus as claimed in claim 6, wherein said means for introducing said liquid comprises an inlet line extending through said top of said isothermal mixing baffle, and extending coaxially through a portion of said isothermal mixing baffle.

10 An apparatus as claimed in claim 6, wherein said means for removing said gas comprises an outlet line in fluid communication with the top of said isothermal mixing baffle.

11. An apparatus as claimed in claim 6, wherein two or more isothermal mixing baffles are immersed in said contents.

12. An apparatus as claimed in claim 6, wherein said isothermal mixing baffle is inserted into said reaction vessel through said top of said reaction vessel.

13. An apparatus as claimed in claim 6, wherein said isothermal mixing baffle is inserted into said reaction vessel through said bottom of said reaction vessel.

14. An apparatus for supplying saturated or superheated gas to a temperature controlling helical channel coil disposed helically around a reaction vessel, comprising:

an isothermal mixing baffle, immersed in contents contained in said reactor, said mixing baffle containing a saturated or subcooled liquid;

means for supplying vapor discharged from said isothermal mixing baffle to said helical channel coil;

means for monitoring flow of said vapor into said helical channel coil; and,

means for controlling flow of vapor into said helical channel coil.

15. An apparatus according to claim 14, including a phase separator for receiving a working fluid selected from the group consisting of nitrogen, helium, brine, steam, chilled water, carbon dioxide, ammonia, CF4, methanol, ethanol, ethane, ethylene, methane, R134A and hot water, said phase separator including means to separate and direct saturated vapor phases to said temperature controlling helical channel coil or a device for mixing said saturated vapor phase with gas discharged from said isothermal mixing baffles.

16. A method for controlling the temperature in a reaction vessel comprising the steps of:

disposing a helical channel temperature control coil around an outside surface of said reaction vessel;

introducing a heat transfer working fluid into a phase separator;

withdrawing a liquid portion of said working fluid from said phase separator and introducing said liquid portion into an isothermal mixing baffle disposed in contents contained in said reaction vessel;

withdrawing a vapor portion of said working fluid from said phase separator and mixing it with a vapor phase working fluid withdrawn from said isothermal mixing baffle to produce a mixed heat exchange fluid; and

introducing said mixed heat exchange fluid into said helical channel coil.

17. A method according to claim 16, including the step of:

selecting said heat transfer fluid from the group consisting of nitrogen, helium, brine, steam, chilled water, carbon dioxide, ammonia, CF4, methanol, ethanol, ethane, ethylene, methane R134A, and hot water.

18. A method according to claim 16, including the step of:

controlling flow rate of liquid flow into said isothermal mixing baffle to control heat transfer to said contents in said reaction vessel.

19. A method according to claim 16, including the step of:

controlling level of liquid heat transfer agent in said isothermal mixing baffle to control heat transfer of said contents in said reaction vessel.

20. A method according to claim 16, including the step of:

heating said contents in said reaction vessel by introducing a hot gas into said isothermal mixing baffle.